

CLAIMS

1. A windshield heated liquid spray assembly comprising:
5 a liquid heating assembly; and
a heated liquid spray assembly operative to spray heated liquid onto a windshield,
said liquid heating assembly comprising:
a liquid heating chamber;
10 at least one heating element disposed in said liquid heating chamber;
and
at least one heat dissipator in heat conduction contact with said at least one heating element, said at least one heat dissipator at least partially defining at least one liquid flow channel and being operative to transfer heat from said at least one
15 heating element to said liquid flowing through said at least one liquid flow channel.
2. A windshield heated liquid spray assembly according to claim 1 and also comprising a liquid temperature sensor operative to sense a temperature of liquid heated by said liquid heating assembly and wherein said at least one heat dissipator is
20 configured and operative to enhance homogeneity of heating of said liquid in said liquid heating chamber, whereby said temperature sensed by said liquid temperature sensor is generally representative of the temperature of said liquid within said liquid heating chamber.
- 25 3. A windshield heated liquid spray assembly according to claim 1 or claim 2 and wherein said at least one heat dissipator is configured to be non-uniform along at least one dimension of said liquid heating chamber.
4. A windshield heated liquid spray assembly according to claim 1 or claim
30 2 and wherein said at least one heat dissipator is configured to extend along a longitudinal axis, which is intended to be aligned vertically and is non-uniform along

said longitudinal axis, thereby to enhance homogeneity of heating of said liquid therealong.

5 5. A windshield heated liquid spray assembly according to any of the preceding claims and wherein said at least one heat dissipator includes at least one aperture communicating with said at least one liquid flow channel.

10 6. A windshield heated liquid spray assembly according to any of the preceding claims and wherein said at least one heat dissipator is located within said liquid heating chamber to define at least one fluid flow gap.

7. A windshield heated liquid spray assembly according to claim 6 and wherein said at least one fluid flow gap causes fluid flow within said liquid heating chamber in multiple directions.

15 8. A windshield heated liquid spray assembly according to claim 6 or claim 7 wherein said at least one heat dissipator is configured to extend along a longitudinal axis and wherein said fluid flow in multiple directions includes fluid flow in opposite longitudinal directions along said longitudinal axis.

20 9. A windshield heated liquid spray assembly according to any of claims 6-8 and wherein said fluid flow in multiple directions provides enhanced homogeneity of temperatures of said liquid in said liquid heating chamber.

25 10. A windshield heated liquid spray assembly comprising:
a liquid heating assembly; and
a heated liquid spray assembly operative to spray heated liquid onto a windshield,
said liquid heating assembly comprising:
30 a liquid heating chamber;
at least one heating element disposed in said liquid heating chamber;
and

an electrical power supply connection to said at least one heating element, said electrical power supply connection including a meltable conductor portion in heat conductive contact with said liquid heating chamber and being operative to melt, and thus interrupt supply of electrical power to said at least one heating element in response to heating of liquid in said liquid heating chamber above a predetermined temperature.

11. A windshield heated liquid spray assembly according to claim 10 and also comprising at least one heat dissipator in heat conduction contact with said at least one heating element, said at least one heat dissipator at least partially defining at least one liquid flow channel and being operative to transfer heat from said at least one heating element to said liquid flowing through said at least one liquid flow channel.

12. A windshield heated liquid spray assembly according to claim 11 and also comprising a liquid temperature sensor operative to sense a temperature of liquid heated by said liquid heating assembly and wherein said at least one heat dissipator is configured and operative to enhance homogeneity of heating of said liquid in said liquid heating chamber, whereby said temperature sensed by said liquid temperature sensor is generally representative of the temperature of said liquid within said liquid heating chamber.

13. A windshield heated liquid spray assembly according to claim 11 or claim 12 and wherein said at least one heat dissipator is configured to be non-uniform along at least one dimension of said liquid heating chamber.

14. A windshield heated liquid spray assembly according to claim 11 or claim 12 and wherein said at least one heat dissipator is configured to extend along a longitudinal axis, which is intended to be aligned vertically and is non-uniform along said longitudinal axis, thereby to enhance homogeneity of heating of said liquid therealong.

15. A windshield heated liquid spray assembly according to any of claims 11-14 and wherein said at least one heat dissipator includes at least one aperture communicating with said at least one liquid flow channel.
- 5 16. A windshield heated liquid spray assembly comprising:
a liquid heating assembly; and
a heated liquid spray assembly operative to spray heated liquid onto a windshield,
said liquid heating assembly comprising:
10 a liquid heating chamber;
at least one heating element disposed in said liquid heating chamber;
and
a liquid supply assembly coupled to said liquid heating chamber and including:
15 a valve operative to allow liquid flow into said liquid heating chamber and to impede backflow from said liquid heating chamber; and
at least one bypass conduit, user selectably operative to allow said backflow to bypass said valve.
- 20 17. A windshield heated liquid spray assembly comprising:
a liquid heating assembly;
a liquid temperature sensor operative to sense a temperature of liquid heated by said liquid heating assembly;
a heated liquid spray assembly operative to spray said heated liquid onto
25 a windshield; and
a controller operative to control operation of said spray assembly in accordance with said temperature sensed by said liquid temperature sensor, said controller providing at least one first spray instance beginning when said liquid temperature is at a first temperature and terminating when said liquid temperature is at a
30 second temperature, below said first temperature, and at least one second spray instance terminating when said liquid temperature is at a third temperature, below said second temperature.

18. A windshield heated liquid spray assembly according to claim 17 and also comprising a temperature sensor operative to sense an ambient temperature outside of said liquid heating assembly and wherein said third temperature is determined by said controller based on said ambient temperature.

19. A windshield heated liquid spray assembly according to claim 17 or claim 18 and wherein said controller is operative to terminate said at least one first spray instance if said second temperature is not reached within a predetermined time.

20. A windshield heated liquid spray assembly according to any of claims 17-19 and wherein said controller is operative to terminate said at least one second spray instance if said third temperature is not reached within a predetermined time.

21. A windshield heated liquid spray assembly according to any of claims 17-20 and wherein said at least one second spray instance begins when said liquid temperature is at said first temperature.

22. A windshield heated liquid spray assembly according to any of claims 17-21 and wherein said liquid heating assembly also includes an electrical power supply connection to said at least one heating element, said electrical power supply connection including a meltable conductor portion in heat conductive contact with said liquid heating chamber and being operative to melt, and thus interrupt supply of electrical power to said at least one heating element in response to heating of liquid in said liquid heating chamber above a predetermined temperature.

23. A windshield heated liquid spray assembly according to any of claims 17-22 and also comprising at least one heat dissipator in heat conduction contact with said at least one heating element, said at least one heat dissipator at least partially defining at least one liquid flow channel and being operative to transfer heat from said at least one heating element to said liquid flowing through said at least one liquid flow channel.

24. A windshield heated liquid spray assembly according to claim 23 and also comprising a liquid temperature sensor operative to sense a temperature of liquid heated by said liquid heating assembly and wherein said at least one heat dissipator is
5 configured and operative to enhance homogeneity of heating of said liquid in said liquid heating chamber, whereby said temperature sensed by said liquid temperature sensor is generally representative of the temperature of said liquid within said liquid heating chamber.
- 10 25. A windshield heated liquid spray assembly according to claim 23 or claim 24 and wherein said at least one heat dissipator is configured to be non-uniform along at least one dimension of said liquid heating chamber.
- 15 26. A windshield heated liquid spray assembly according to claim 23 or claim 24 and wherein said at least one heat dissipator is configured to extend along a longitudinal axis, which is intended to be aligned vertically and is non-uniform along said longitudinal axis, thereby to enhance homogeneity of heating of said liquid therealong.
- 20 27. A windshield heated liquid spray assembly according to any of claims 23-26 and wherein said at least one heat dissipator includes at least one aperture communicating with said at least one liquid flow channel.
- 25 28. A method for spraying heated liquid onto a windshield comprising:
providing a liquid heating assembly including a liquid heating chamber,
at least one heating element disposed in said liquid heating chamber and at least one heat dissipator in heat conduction contact with said at least one heating element, said at least one heat dissipator at least partially defining at least one liquid flow channel;
heating said at least one heating element;
30 transferring heat from said at least one heating element to liquid flowing through said at least one liquid flow channel; and
spraying said liquid heated by said liquid heating assembly onto a

windshield.

29. A method for spraying heated liquid onto a windshield comprising:
providing a liquid heating assembly including a liquid temperature

5 sensor;

heating a liquid in said liquid heating assembly until a first spray cycle
start temperature is sensed by said liquid temperature sensor;

beginning at least one first spray instance when said first spray cycle start
temperature is sensed by said liquid temperature sensor;

10 terminating said first spray instance when a first spray cycle end
temperature is sensed by said liquid temperature sensor; said first spray cycle end
temperature being below said first spray cycle start temperature;

subsequently beginning at least one second spray instance when a second
spray cycle start temperature is sensed by said liquid temperature sensor; and

15 terminating said second spray instance when a second spray cycle end
temperature is sensed by said liquid temperature sensor, said second spray cycle end
temperature being below said first spray cycle end temperature.